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Improving Wheat productivity through Resource Conservation Techniques and Weed Management

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ABSTRACT

Field experiment was conducted during the rabi season of 2016-17 and 2017-18 to study the effect of resource conservation techniques (RCTs) and herbicides on weeds and yield of wheat. The relative density of P. hysterophorus and C. didymus were higher under zero tillage condition while under conventional tillage higher density of C. album and A. arvensis were recorded. The total weed density and dry weight were significantly lower under conventional tillage as compare to zero tillage condition. The data of weed dynamics indicated that, weed density and weed dry weight of broad leaf were decreased significantly with used herbicides as compared to weedy check. However, the maximum reduction of major broad leaf weeds were noticed under halauxifen methyl at 12.76 g/ha treated plots which was statistically similar to application of metsulfuron methyl at 5g/ha in respect to control of broad leaf weeds. Significantly higher grain yield was recorded under conventional tillage as compared to zero tillage. The maximum grain yield (5 t/ha) was recorded with weed free environment, that was 43 per cent higher than weedy check. Among the various applied herbicides maximum grain yield was recorded under metsulfuron methyl at 5g/ha treated plot which was very similar to application of halauxifen methyl ester at 12.76 g/ha condition.

KEYWORDS

Resource conservation techniques, Herbicides, Wheat, Weeds, Broad leaf weed

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INTRODUCTION

Wheat (Triticum aestivum L. emend Fiori & Paol.) is an important food crop in many countries and widely grown in almost all part of India. It is backbone of food and nutrition security for our country, contributing about 33% of food grain production. For the food and nutritional security of burgeoning population, the yield maximization is quite imperative and production target set to meet the ever- increasing demand of wheat and wheat product of Indian population to the tune of 140 mt by 2050 AD (ICAR-IIWBR, 2019). The productivity, sustainability and profitability of wheat production are at stagnation. Therefore, there is a need of technologies which reduces cost of cultivation and improves their net return. Farmers need environment friendly technologies which have less deleterious effect on the natural resources. Under such situation conservation agriculture based resource conservation techniques (RCTs) viz. zero tillage (ZT) and furrow irrigated raised bed system (FIRBS) could be valid option to reduce turnaround time, water, cost of cultivation and finally ensure higher net return.

Among the various factors responsible for low wheat production, weeds are considered to be principal biotic constraints and bring severe interference with normal crop growth, as they compete for resources like nutrient, moisture, light and space and reduce wheat yield by 37 to 50% (Waheed *et al*, 2009) . Herbicides on account of their selectivity are most important tools in wheat management to sustained yield and quality of crop produce ((Mitra *et al*, 2019). Hence, present experiment was undertaking to find out effect of resource conservation techniques and herbicides for broad leaved weed management in wheat crop.

MATERIALS AND METHODS

A field experience was carried out during winter (rabi) season of 2016-17 and 2017-18 at agricultural research farm (Pili Kothi) of T.D.P.G. College, Jaunpur in the Northern gangetic alluvial plains having characteristics of sub-tropical climate. The soil of experimental field was sandy loam with 0.3% organic carbon. The treatment consisted three resource conservation techniques viz. zero tillage (ZT) conventional tillage (CT) and furrow irrigated raised bed system (FIRBS) in main plot and six weed control measures viz. 2,4-D Na salt at 500 g./ha, carfentra zone at 20g/ha, halauxifen-methyl ester at 12.76 g/ha, at 5g/ha, weedly check and weed-free in sub plot were laid out in split plot design with three replication.

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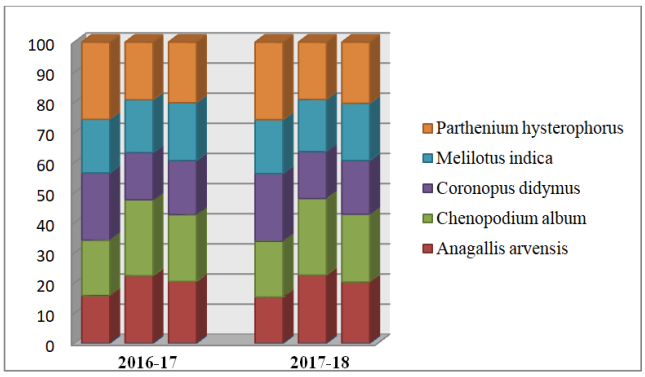

Fig. 1: Percent composition of major broad leaf weeds in weedy check at 30 DAS

RESULTS AND DISCUSSION

The broad leaf weeds observed under ZT, CT and FIRBS condition were Parthenium hysterophorus, Anagallis arvensis, Chenopodium album, Coronopus didymus, Melilotus indica, Rumex acetosella, Lathyrus aphaca and Convolvulus arvensis. Two weed species other than broad leaf weeds were also present in experimental field that are Cyperus rotundus and Cynodon dactylon. The per cent composition of P.hysterophorus and C. didymus were comparatively higher than A. arvensis, M. indica and C. album under zero tillage condition whereas relatively higher composition of C. album and A. arvensis were recorded under conventional tillage when compared to other dominant broad leaf weeds at 30DAS during both the years (Figure 1). Lower density of P.hysterophorus might due to the fact that P.hysterophorus is non field crop weed that prefer their germination under undisturbed condition.

Table 1: Effect of resource conservation techniques and herbicides on density (No./m^2) of major broad leaf weed at 60 DAS

Treatments	A. arvenesis		C album		C. didymux		M. indica		P.hysterophorus		Others	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
ZT	4.16 (16.33)	4.00 (15)	4.32 (17.67)	4.24 (17)	4.80 (22)	4.66 (20.67)	4.36 (18)	4.24 (17)	5.20 (26)	5.03 (24.33)	4.01 (15)	3.87 (14)
CT	4.36 (18)	4.28 (17.33)	4.58 (20)	4.47 (19)	3.74 (13)	3.70 (12.67)	3.87 (14)	3.92 (14.33)	4.00 (15)	3.96 (14.67)	3.32 (10)	3.16 (19)
FI RBS	4.24 (17)	4.12 (16)	4.47 (19)	4.36 (18)	4.01 (15)	3.96 (14.67)	4.12 (16)	15 (4.01)	4.23 (17)	4.28 (17.33)	3.46 (11)	3.32 (10)
LSD (5%)	NS	0.21	0.22	0.21	0.24	0.25	0.25	0.24	0.27	0.26	0.25	0.27
WCM 2,4 D NA at 500g/ha	2.23 (4)	2.16 (3.67)	2.24(4)	2.24 (4)	2.65 (6)	2.51 (5.33)	2.45 (5)	2.38 (4.67)	2.65 (6)	2.52 (5.33)	3.00 (8)	2.99 (8)
Carfentrazone at 20g/ha	2.31 (4.33)	2.24 (4)	2.16 (3.67)	2.23 (4)	2.52 (5.33)	2.45 (5)	2.38 (4.67)	2.31 (4.33)	2.45 (5)	2.38 (4.67)	2.82 (7)	2.83 (7)
Halauxifen-methylester at 12.76g/ha	1.41 (1.0)	1.42 (1.0)	1.63 (1.67)	1.53 (1.33)	1.42 (1.0)	1.41 (1.0)	1.53 (1.33)	1.52 (1.33)	1.73 (2)	1.74 (2.0)	2.45 (5)	2.31 (4.33)
Metsulfuron methyl at 5g/ha	1.53 (1.33)	1.52 (1.33)	1.73 (2.0)	1.63 (1.67)	1.52 (1.33)	1.53 (1.33)	1.53 (1.33)	1.53 (1.33)	1.63 (1.67)	1.52 (1.33)	2.52 (5.33)	2.45 (5)
Weedy check	5.39 (28)	5.29 (27)	5.92 (34)	5.83 (33)	5.10 (25)	5.04 (24.33)	4.5 8(20)	4.55 (19.57)	5.82 (33)	5.74 (32)	4.58 (20)	4.74 (19)
Weed free	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)
LSD(5%)	0.32	0.30	0.43	0.41	0.28	0.27	0.25	0.25	0.37	0.35	0.33	0.34

Original data given in parenthesis were subjected to square root ($\sqrt{x+1}$) transformation before analysis

Among the dominant weed flora of broad leaf weeds, the average density of P.hysterophorus (25.17/m^2) and C. didymus (21.33/m^2) were significantly higher under zero tillage condition as compared to furrow irrigated raised bed system and conventional tillage condition but density of M. indica was significantly higher under zero tillage when compared to conventional tillage and remain statistically similar with FIRBS condition.

Table 2: Effect of resource conservation techniques and weeds control measure on total weed density and dry weight (60DAS) and grain yield of wheat crop

Treatments	Total weed density (No. m^2)		Weed dry weight (g/m^2)		Grain yield (Mg/ha)	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
Resource conservation techniques						
ZT	10.73(115)	10.39(108)	6.16(37)	6.0 (35)	3.89	3.97
CT	9.54(90)	9.38(87)	5.48(29)	5.39(28)	4.74	4.85
FIRBS	9.80(95)	9.59 (91)	5.67(30)	5.48(29)	4.42	4.63
LSD (5%)	0.62	0.60	0.54	0.49	0.33	0.35
Weed control measures						
2,4-D Na at 500g/ha	5.83(33)	5.66(31)	3.38 (10.4)	3.32 (10.0)	4.01	4.03
Carfentrazone at 20g/ha	5.57(30)	5.48(29)	30.30(9.9)	9.8 (3.29)	4.00	4.02
Halauxifen-methyl ester at 12.76g/ha	3.61(12)	3.46(11)	2.19 (3.8)	2.12 (3.5)	4.70	4.72
Metsulfuron methyl at 5g/ha	3.74(13)	3.60(12)	4.0 (2.24)	2.14 (3.6)	4.71	4.72
Weedy check	12.69(160)	12.49(155)	7.19(50.7)	7.04 (48.6)	3.48	3.51
Weed free	1.00(0)	1.00(0)	1.0 (0)	1.0 (0)	5.00	5.00
LSD (5%)	1.02	1.00	0.29	0.28	0.27	0.28

Original data of total weed density and dry weight given in parentheses were subjected to square root ($\sqrt{x+1}$) transformation before analysis.

The population per unit area of A. arvensis was statistically similar under all resource conservation techniques during 2016-17 but significant difference was noticed between zero and conventional tillage in respect to density of A. arvensis during 2017-18. Significantly higher density of C. album was observed under conventional tillage as compared to zero tillage but remain at par under FIRBS and conventional tillage condition during both the years (Table 1).

Total weed density and dry weight recorded under conventional tillage was significantly lower than zero tillage but remain at par with furrow irrigated raised bed system (Table 2). This might be due to more congenial environment in convention tillage for crop growth. This result is in conformity with earlier finding of (Jat *et al*, 2013).

The maximum and minimum density of individual broad leaf weed and total weed were recorded in weedy check and weed free condition, respectively at 60 DAS during both the years. Application of herbicides resulted significant reduction of broad leaf weed density when compared to weedy check. Among the herbicides, spraying of carfentrazone at 20 g/ha was found least effective and halauxifen methyl ester at 12.76 g/ha become most effective for controlling individual weed population per unit area which ultimately change in total weed density and dry weight during both the years. Use of halauxifen methyl estar at 12.76 g/ha resulted significant reduction in the density of A.arvensis, C. album, C.didymus, M. indica and P. hysterophorus when compared with 2.4-D Na at 500g/ha, Carfentrazone at 20g/ha and weedy check but remain at par with metsulfuron methyl at 5g/ha. Walia and Singh (2005) reported better efficacy of metsulfuron methyl against broad leaf weeds. Variation in reduction in broad leaf weed density, total weed population per unit area and dry weight due to different herbicides might be due to differential selectivity toward broad leaf weeds. Sharma and Solanki (2020) also reported that halauxifen methyl estar @ 12.76g/ha, metsulfuron methyl @ 4g/ha, Carfentrazon @ 20 g/ha and 2,4-D Na(80WP) 500g/ha gave effective control of broad leaf weeds in wheat crop.

The grain yield of wheat crop was significantly higher under CT when compared with ZT but remain statistically similar with FIRBS during both the years. This might be due to better physical condition of soil during initial growth stage of crop. All weed control measures recorded significantly higher grain yield as compare to weedy check. Among various applied herbicides highest grain yield was recorded under metsulfuron methyl at 5g/ha treated plots which was very close to halauxifen methyl at 12.76 g/ha treated condition (Table 2). It might be owing to control of weeds, which increased the availability of various inputs to plants by decreasing crop weed competition. Chhokar *et al* (2015) reported maximum wheat yield under spray of halauxifen-methyl ester at 12.76g/ha and metsulfuron methyl at 4g/ha condition as it effectively control broad leaf weds.

CONCLUSION

On the basis of this trial, it was concluded that P. hysterophorus was dominated under zero tillage and C. album under conventional tillage condition. Application of halauxifen-methyl easter at 12.76g/ha and metsulfuron methyl at 5g/ha were effective herbicides for broad leaf weeds control and resulted 35 per cent higher grain yield over uncontrolled weed condition.

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